Separating the North and South Pacific Meridional Modes contributions to ENSO and tropical decadal variability

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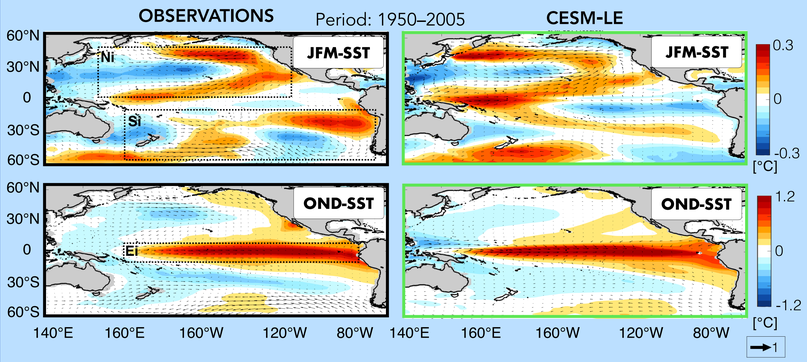
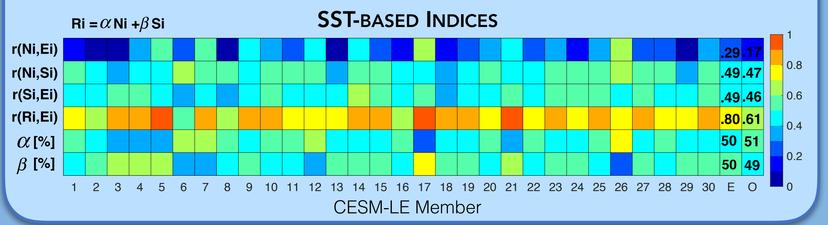
1. Introduction

The spatial signature of the extratropical dynamics affecting ENSO is revealed by performing a simple analysis where the PC1 of OND mean SSTa in the equatorial Pacific is regressed onto preceding SST anomalies of JFM of the same year.



The importance of these extratropical patterns in driving the tropical Pacific variability can be quantified using time indices for the north and south precursor patterns (i.e., Ni and Si), which are obtained by projecting extratropical JFM anomalies onto the precursor patterns, to predict the OND ENSO index (i.e., Ei).



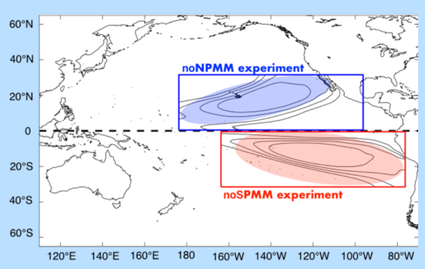
2. The Question

What are the North and South Pacific Meridional Modes contributions to ENSO and tropical decadal variability?

3. Experiment Design

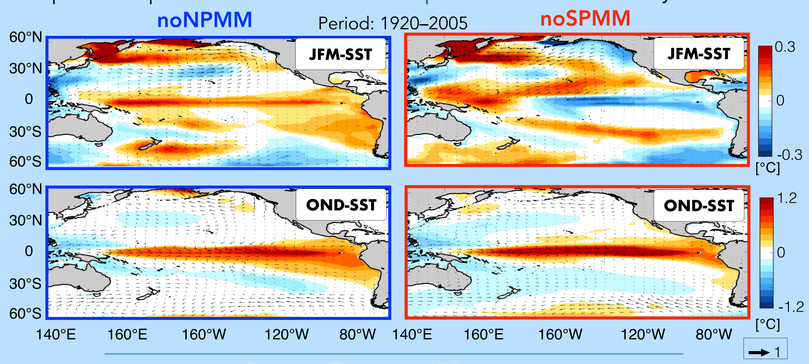
The **NPMM** or the **SPMM** variability is suppressed by restoring the SST to the monthly mean climatology only in the region where these modes are most active.

- CESM version 1
- Resolutions: 1°x1°
- Period: 1920-2005
- Forcing: Aerosol and GHG
- Restoring to monthly SST clim.

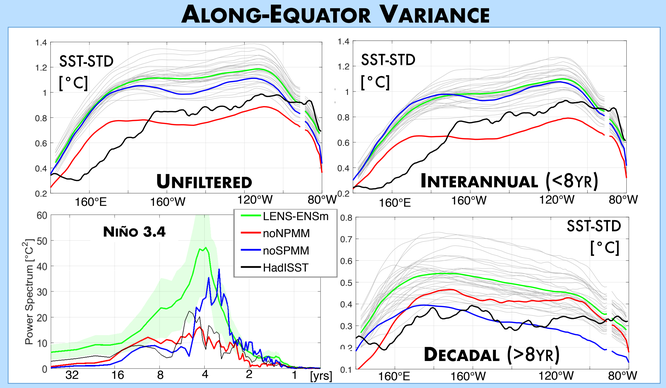


4. Results: impacts of NPMM and SPMM on ENSO

While ENSO precursor patterns in noSPMM experiment are largely unchanged, the precursor patterns for the noNPMM experiment are substantially different.

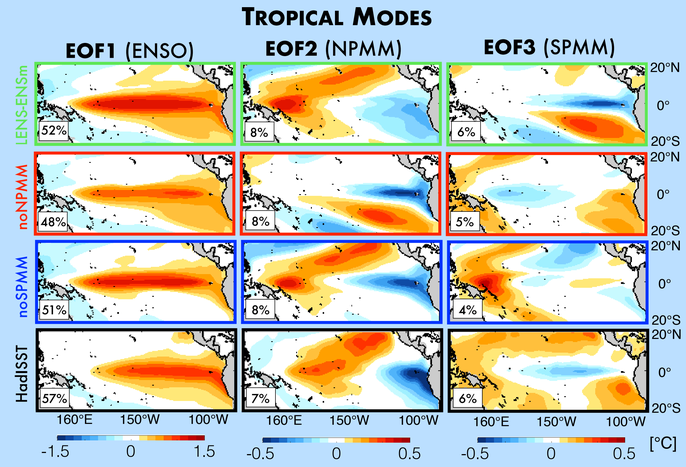


ALONG-EQUATOR VARIANCE



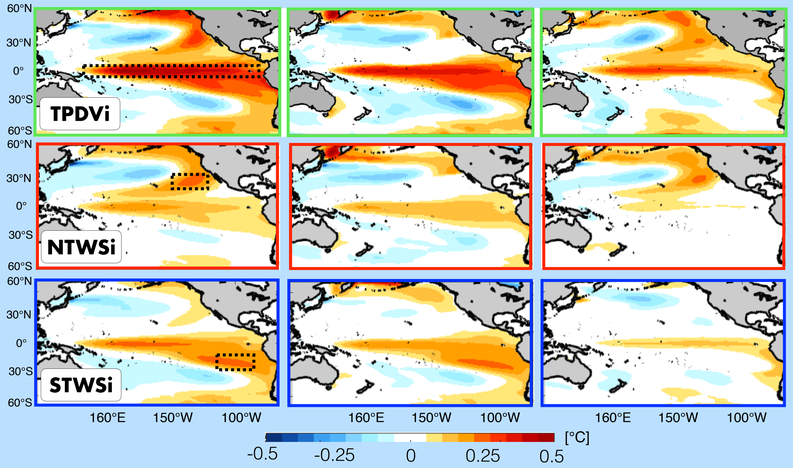
- The suppression on the **NPMM** result in a significant reduction (~35%) only of the **interannual** component.
- The suppression on the **SPMM** result in a significant reduction (~30%) only of the **decadal** component.

TROPICAL MODES



5. Results: impacts of NPMM and SPMM on TPDV

Regression maps of 8–yr low-passed SSTa with indices of the northeasterly and southeasterly trade winds strength (NTWSi and STWSi) reveal that the STWSi presents a larger signal in the Tropics that resemble more closely the TPDV pattern.



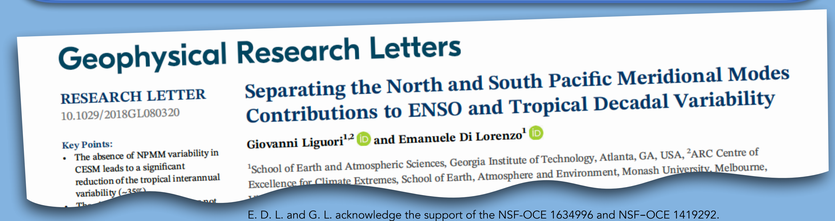
HYPOTHESES AND CAVEATS

The latitudinal asymmetry of the ITCZ allows the extratropical atmospheric variability to drive SST changes in the southeast equatorial pacific by modulating the intensity of southeasterly trade winds .

Some results may be model dependent, thus further confirmation in other climate models is needed.

6. Take-home messages

- The **NPMM** impacts the **interannual** (ENSO) variability of Trop. Pac. SST.
- The **SPMM** impacts the **decadal** (TPDV) variability of Trop. Pac. SST.
- **Southeasterly trades** play a key role in energizing the **TPDV.**



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